

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): A regeneration process of an etching solution composed of a phosphoric acid solution and used in etching silicon nitride films in an etch bath, which comprises the following steps:

 taking said etching solution out of said etch bath, said etching solution containing a silicon compound formed by said etching, and adding water to said taken-out etching solution to lower a concentration of phosphoric acid in said etching solution to 80 to 50 wt.%; and

 removing said silicon compound, which has precipitated in said etching solution by said lowering of said concentration of phosphoric acid, from said etching solution,

wherein subsequent to said removal of said silicon compound from said etching solution, said concentration of phosphoric acid in said etching solution is raised to 80 to 90 wt.%.

Claim 2 (Currently Amended): [[A]] The regeneration process according to claim 1, wherein said removal of said silicon compound from said etching solution is conducted by filtration.

Claim 3 (Currently Amended): [[A]] The regeneration process according to claim 1, wherein said concentration of phosphoric acid in said etching solution is lowered to 75 to 50 wt.%.

Claim 4 (Currently Amended): [[A]] The regeneration process according to claim 1, wherein upon diluting said etching solution, said etching solution is cooled to 100°C to room temperature.

Claim 5 (Currently Amended): [[A]] The regeneration process according to claim 1, wherein subsequent to said removal of said silicon compound from said etching solution, said etching solution is heated to 140°C to 180°C.

Claim 6 (Canceled).

Claim 7 (Currently Amended): A process for etching silicon nitride films with an etching solution, which is composed of a phosphoric acid solution, in an etch bath, which comprises the following steps:

taking said etching solution out of said etch bath during or after said etching, said etching solution containing a silicon compound;

regenerating said etching solution by a process according to any one of claims [[1-6]] 1-5; and returning said thus-regenerated etching solution to said etch bath.

Claim 8 (Currently Amended): A process for etching silicon nitride films with an etching solution, which is composed of a phosphoric acid solution, in an etch bath, which comprises the following steps:

taking said etching solution out of said etch bath during or after said etching, said etching solution containing a silicon compound;

dividing the taken-out etching solution into two streams;

filtering said etching solution (A) in one of said two streams and returning the thus-filtered etching solution to said etch bath;

regenerating said etching solution (B) in the other stream by a process according to any one of claims [[1-6]] 1-5; and

combining said regenerated etching solution (B) with said filtered etching solution (A), and returning said thus-combined etching solution to said etch bath.

Claim 9 (Withdrawn): An etching system for practicing an etching process according to claim 7 or 8, comprising:

a dilution and precipitation unit for taking said etching solution out of said etch bath, the etching solution containing said silicon compound, and diluting said taken-out etching solution with water to precipitate said silicon compound,

a filtration unit for said silicon compound, and

at least one of a concentration unit and heating unit for said etching solution,

wherein said dilution and precipitation unit, said filtration unit and said at least one of said concentration unit and heating unit are arranged in the order that they are presented.

Claim 10 (New): The regeneration process according to claim 1, wherein said concentration of phosphoric acid in said etching solution is lowered to 80 to 70 wt.%.

Claim 11 (New): The regeneration process according to claim 1, wherein said concentration of said silicon compound after removal from said etching solution is less than 30 ppm.

Claim 12 (New): The regeneration process according to claim 1, wherein said concentration of said silicon compound after removal from said etching solution is less than 15 ppm.

Claim 13 (New): The regeneration process according to claim 1, wherein said concentration of said silicon compound after removal from said etching solution is less than 3 ppm.

SUPPORT FOR THE AMENDMENT

Claim 1-5, 7 and 8 are currently amended.

Claim 6 is canceled without prejudice or disclaimer.

Claims 10-13 are added.

Support for the amendment to claim 1 can be found in claim 6, as originally filed.

Support for added claims 10-13 can be found in Example 1 of the specification at pages 28-29, paragraphs [0051] to [0052], as originally filed.

Claims 2-5, 7, and 8 have been amended for minor editorial purposes.

No new matter has been added by the amendments.

Upon entry of the amendments, claims 1-13 will be pending in the present application. It is noted that claim 9 was previously withdrawn in view of a Restriction Requirement.

REQUEST FOR RECONSIDERTION

The present invention relates to a regeneration process of an etching solution (amended claim 1); a process for etching silicon nitride films with an etching solution (claims 7 and 8) that includes the regeneration process of claim 1; and an etching system (claim 9) for practicing the etching process of claim 7 or claim 8. The cited prior of record does not describe or suggest the features of the regeneration process according to claimed invention, in view of the Response and Request for Reconsideration filed May 15, 2006, and in view of the present amendment.

Accordingly, the rejection of claims 1-8 under 35 U.S.C. § 103(a) as obvious over Yokomizo et al. (U.S. Patent No. 6,399,517) is traversed and obviated by amendment, and reconsideration is requested in view of the following remarks.

The evidence of record clearly demonstrates that claimed invention is novel and unobvious over the reference. Applicants have provided Table 1, as shown in the present specification at page 28, paragraph [0051] and reproduced in further detail in the Response and Request for Reconsideration filed May 15, 2006. The table shows the excellent results obtained by taking an etching solution out of an etch bath, etching solution containing a silicon compound formed by the etching, and adding water to the taken-out etching solution to the claimed specific lower a concentration of phosphoric acid in the etching solution.

In particular, Applicants have found, *inter alia*, that a **concentration higher than 80%** of phosphoric acid in the diluted etching solution leads to insufficient precipitation of the silicon compound from the etching solution and fails to exhibit the capturing removal effect of the silicon compound by filtration in a subsequent step. A **concentration lower than 50%** of phosphoric acid in the diluted etching solution, on the other hand, requires a great deal of water for dilution although the effect of promoting the precipitation of the silicon compound is not improved in proportion to the dilution.

In contrast, the process in the reference does not describe or provide any evidence regarding the addition of a specific quantity of water to obtain a certain concentration, nor does the reference provide any guidance for a regeneration process that would or should be modified to include such a concentration. As such, the only way that the Office could make the generalization that the claimed invention would be obvious is based on hindsight of the present specification, which is improper.

Therefore, for at least the above-reason, the rejection should be withdrawn.

Moreover, Applicants note that claim 1 now has been amended to include the features of claim 6, in which “subsequent to said removal of said silicon compound from said etching solution, said **concentration of phosphoric acid** in said etching solution is **raised to 80 to 90 wt.%**.” As noted in the present specification at page 8, paragraphs [0010] and [0016],

[a]fter the filtration, it is preferred to concentrate the etching solution such that the concentration of phosphoric acid in the etching solution is raised to 80 to 90%.

[In particular,] arrangement of the concentration unit on an upstream or downstream side of the heating unit makes it possible to raise the concentration of phosphoric acid in the etching solution to 80 to 90% . . . to efficiently conduct continuous etching.

(Emphasis added).

In contrast, there is no description or suggestion whatsoever in the reference to *raise* the concentration of phosphoric acid in an etching solution in the manner presently claimed, or for any reason.

Moreover, Applicant point out that the purposes of adding water to an etching solution differ greatly between the present invention and the Yokomizo et al. reference. For instance, in the present invention, “the etching solution and water are mixed together” for the purpose of precipitating the silicon compound contained in the etching solution, as recited on page 13, paragraph [0028] of the present specification.

In the reference, however, the purpose of the addition of water to the etching liquid is to compensate lost water through evaporation, because the etching liquid is used at the boiling point condition continuously, as evidenced by the description at column 6, lines 12-47 of the reference. Further, the reference indicates that water is added to the etching solution in order to maintain the concentration of the etching liquid to a "designated value", as described at column 6, lines 56-59 of the reference. However, it is noted that there is no description or indication of that "designated value", nor any guidance or suggestion that the value relates to any aspect of the claimed invention.

Thus, the purposes of adding water to an etching solution *and* the quantities of the water to be added to the etching solutions clearly distinguish the present invention.

Therefore, in light of the above-additional reason, the claimed invention is novel and unobvious over the Yokomizo et al. reference.

Applicants also submit that added claims 10-13 are novel and unobvious, since these claims depend from claim 1 and the reference does not describe or suggest these claim features.

Accordingly, withdrawal of the rejection is requested.

Applicants request rejoinder of non-elected claim 9, as provided under the provisions of MPEP § 821.04.

Applicants submit that the application is now in condition for allowance. Early notification of such allowance is earnestly solicited.

Respectfully submitted,

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